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The Improvement of Statistics of Cause of Death Through Supplementary Inquiries to Physicians

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THE IMPROVEMENT OF STATISTICS OF CAUSE OF DEATH THROUGH SUPPLEMENTARY INQUIRIES TO PHYSICIANS.

BY LOUIS I. DUBLIN, *Statistician*, and EDWIN W. KOPF, *Chief Clerk, Statistical Bureau, Metropolitan Life Insurance Company, New York.*

The extension of the registration of vital statistics and the consequent increase in the amount of available data on American mortality have resulted in recent years in the development of a critical spirit toward these statistics. When data were scant, they were perforce accepted with little or no question; today we are justified in inquiring to what extent the returns are an accurate picture of the actual conditions. Perhaps enough material is now at hand to enable one to separate the probably true from the uncertain in our mortality returns. This questioning is clearly warranted by the likelihood that the sources of our statistics will thus be improved. It is only as our basic material is sound that the death rates we quote have real value.

The chief source of error in the statistics of mortality is, of course, the uncertainty of the primary diagnosis made by the physician certifying to the cause of death. A group of clinicians and pathologists, represented by Cabot,* Oertel,† and Emerson,‡ have in recent years contributed stimulating and constructive studies of the general reliability of diagnoses made in fatal cases. These writers point out, for example, that the acute infections, like typhoid fever, scarlet fever, and diphtheria, and those conditions which are usually of long duration and present distinct clinical pictures, like pulmonary tuberculosis and the external cancers, furnish no special difficulties of diagnosis to the physician, and statements with regard to them may be accepted without further question. On the other hand, bedside diagnoses, even in our best hospi-

* Cabot, Richard C., M.D.: Diagnostic Pitfalls Identified during a Study of Three Thousand Autopsies, *Journal Amer. Medical Ass'n*, December 28, 1912.

† Oertel, Horst, M.D.: The Inaccuracy of American Mortality Statistics, *American Underwriter*, May, 1913.

‡ Emerson, Haven, M.D.: Reliability of Certain Classes of Death Certificates, *Amer. Jour. Public Health*, August, 1915.

tals, of Bright's disease, of cerebral hemorrhage and apoplexy, and of certain of the heart affections are very frequently not confirmed by autopsy, while other determinative conditions are shown to have been the primary cause of death. Relief from this fundamental difficulty is not within the control of statisticians, but will depend entirely upon the improvement of autopsy facilities and the general rise of standards of medical education. A Committee of the Vital Statistics Section of the American Public Health Association is now actively engaged in considering the International List of Causes of Death from this point of view, registering its conclusions as to those titles which can be accepted with considerable certainty even in the absence of an autopsy, as against those which must be considered as tentative assignments only, unless based on autopsy findings.

The present paper bears on the remedy for a second important source of error which is largely within the scope and control of statisticians. Fortunately, this remedy can be applied at once and surprisingly large corrections in the death rate for certain causes can be made available. The method of procedure consists in attempting to secure from physicians completer statements as to the cause of death, in those cases where the returns on the death certificate are given vaguely or indefinitely, or where there is evidence that the original statements do not tell the entire story. Thus physicians often report conditions like "acute nephritis" as the cause of death, and do not refer at all to the primary condition, such as "scarlet fever," "influenza," or "alcoholism," which was present and known to them. Again, "peritonitis" is frequently reported without reference to the "appendicitis" or to the "puerperal septicemia" which may have preceded it. The various forms of death by violence are still reported vaguely, and without due regard for the statistical requirements of assignment to the International List of Causes of Death. Certificates frequently do not permit one to determine whether death was due to accident, suicide, or homicide, and what was the means and character of the injury.

This report is not the announcement of a discovery in the field of statistics. It is simply an attempt to put on record

the results of a method followed for four years in the Statistical Bureau of the Metropolitan Life Insurance Company, in the treatment of the industrial mortality experience of that company. We have realized that, if our material on the mortality of the American working classes is to be utilized to the full, every effort must be made to improve the quality of the basic data, especially since for many diseases and conditions the death rate is decidedly modified by the extent to which the query system is applied. The method is essentially that followed by the Registrar-General of England and Wales, and by the Division of Vital Statistics in the United States Census Bureau. We desire at this point to acknowledge our indebtedness to Mr. George H. Van Buren, Chief of that Division, who aided materially in the introduction of the method into our office. Both the English* and the American† bureaus have already, in their annuals and in other publications, called attention to the changes resulting from their systems of inquiry. A preliminary statement of the results obtained by our office appeared in the December, 1913, issue of this *QUARTERLY*.‡ In the present paper we shall discuss the effects upon our returns on the basis of the much more extensive data now available. It is our hope that this complete statement will encourage other workers to similar efforts, and that in this way the returns of health departments and insurance companies may become more accurate and comparable.

The technical procedure is as follows: The death certificates attached to the claim papers are carefully examined, and the staff engaged in this work determine whether the statement of cause of death given by the physician is satisfactory and complete for purposes of assignment. Statements of cause presenting no difficulty are at once classified according to the International List of Causes of Death. Joint causes are classified according to the precedents and rules of the International Committee, as best exemplified by the methods of the United

* Registrar-General of Births, Deaths and Marriages. Report, 1913, p. LXXIX.

† Bureau of the Census. Mortality Statistics, 1911, p. 36.

Bureau of the Census. Mortality Statistics, 1912, p. 23.

Van Buren, Geo. H.: Mortality Statistics and the Physician, *Amer. Jour. Pub. Health*, Dec., 1915.

Emerson, Haven, *loc. cit.*

‡ Dublin, Louis I.; Kopf, Edwin W.: Experiment in the Compilation of Mortality Statistics, this *Quarterly*, Dec., 1913.

States Census Bureau. Wherever the statement of cause is considered unsatisfactory for classification, or where, from the statement presented to the Company by the claimant or from other available sources, there is an indication that a serious condition not mentioned on the certificates has contributed to the death, or where additional information is required before a satisfactory assignment can be made, a letter of inquiry, asking for the facts, is sent to the physician. Clerical labor is minimized wherever possible through the use of form letters. A codified series of questions is employed, and the examiners indicate to the typists the question which is to be inserted in the form. The following is a copy of one of our series of letters sent to physicians:

NEW YORK CITY

Dear Doctor:

This Company is analyzing its mortality experience for the year 191 , and in order that we may be able to classify accurately the death of _____ who died on _____, and whose certificate you signed, we most respectfully ask you to send us the following information in addition to the statement now appearing on the death claim, viz.:

Acute nephritis

Additional data desired:

Kindly indicate the primary cause of the ACUTE NEPHRITIS. Due to any contagious or infectious disease (scarlet fever, typhoid fever, etc.)? *Directly* due to alcoholism or exposure? Traumatic? If so, means of injury?

The claim was duly paid by this Company under date of _____ 191 , and this desired information will be used for statistical purposes only. We are confident that your interest in the advancement of the scientific study of Causes of Death will prompt you to comply with our request, and we beg you to accept our thanks. A stamped envelope is enclosed for your reply.

Very respectfully yours,

Statistician.

(Please answer here)

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At first we proceeded cautiously, inquiring only as to the means and character of the injury in cases of ill-defined violence. We also asked for the causes for the relief of which operations were performed (when expressions such as "operation," "surgical shock," or "laparotomy" were reported with no additional data), the causes contributing to "peritonitis," and the

more exact location of cancers and tumors. We asked for additional information when the terms were "dropsy," "heart failure," and others of like character included in the designation "Ill-defined Diseases" in the International Classification. The scope of our questions has since been much extended. The following questions indicate the lines along which inquiry is now made:

UNDESIRABLE RETURNS AND CHARACTER OF INQUIRY MADE.

<i>Undesirable Returns.</i>	<i>Inquiry.</i>
1. "Injury," "Gunshot-Wound," "Drowning," "Accidental death," or other ill-defined violence.	Was death due to accident, suicide, or homicide? If accident, what kind of accident was the primary cause of death (steam railroad, street car, fall, etc.)?
2. "Operation," "Hysterec-tomy," "Laparatomy."	What was the cause, for the relief of which the operation was performed?
3. "Peritonitis."	Was the peritonitis secondary to typhoid fever? To tuberculosis? To puer-peral septicemia? To appendicitis? If postoperative, what was the primary cause? Was it accidental, suicidal, or homicidal? If so, what was the means of injury?
4. "Acute nephritis."	What was the primary cause? Was it a contagious or infectious disease (scar-let fever, typhoid fever, etc.)? Was it directly due to alcoholism or ex-posure? Was it traumatic? If so, what was the means of injury?
5. "Meningitis," or "Cere-brospinal meningitis."	Was it epidemic? Tuberculous? Was it simple meningitis following lobar pneumonia, typhoid fever, or any other contagious or infectious disease? Was it traumatic? If so, what were the means and nature of the injury? Was it accidental, suicidal, or homicidal?
6. "Apoplexy."	Was this a case of cerebral hemorrhage?
7. "Paralysis."	Was it superinduced by cerebral hemor-rhage? Was it a case of spinal paraly-sis? Of general paralysis of the insane?
8. "General paralysis of the insane."	Was it due to syphilis? If so, was the presence of syphilis determined by history or tests?
9. "Locomotor ataxia."	Was it of syphilitic origin? Traumatic? If so, what was the means of injury?

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| 10. "Progressive paralysis." | Was it due to a spinal lesion? Was it directly or remotely due to cerebral hemorrhage? |
| 11. "Tumor." | Was it malignant? What was its location? |
| 12. "Cancer." | What was its location? |
| 13. "Abscess." | What was its location? What was its nature and cause? Was it tuberculous? Traumatic? |
| 14. "Burns." | Was death primarily due to burns received in burning building? (Such deaths are separately classified.) |
| 15. Any terminal condition, origin not stated, such as "Septicemia," "Convulsions," or "Hemorrhage." | What was the primary cause? |
| 16. "Acute cardiac dilatation," "Heart failure." | What was the primary cause? |
| 17. "Pneumonia." | Was it lobar, bronchial, grippal, or tuberculous? Was it traumatic? If so, was death due to accident, suicide, or homicide, and what was the means of injury? |

At the present time we are querying about 8.5 per cent. of the certificates of death received in our office. Satisfactory replies are obtained from physicians in about three quarters of the cases; the proportion varies somewhat with the condition queried. Changes are made in the classification, as the result of inquiry, in about 70 per cent. of the replies received. It is a pleasure at this time to acknowledge our indebtedness to the thousands of physicians whom we have addressed, and who, without reimbursement, have put at our disposal their time and opinion in order to help in the campaign to improve vital statistics. It is an encouraging commentary on the scientific interest of the American practitioner that such a large return could be received.

The following table shows the principal titles in which changes in assignment were made; it shows the number of deaths that would have been assigned to each title without inquiry, the number actually assigned after inquiry, and the ratio of the latter number to the former. The titles are arranged in the increasing order of these ratios.

TABLE I.

NUMBER OF DEATHS FROM CERTAIN CAUSES, BEFORE AND AFTER INQUIRY, AND PROPORTION OF LATTER TO FORMER, ARRANGED IN INCREASING ORDER OF PROPORTIONS.

Metropolitan Life Insurance Company, Industrial Department; Mortality Experience, 1911-1914.

International List Number.	Cause of Death.	Deaths before Inquiry.	Deaths after Inquiry.	Deaths after Inquiry, per 100 Deaths before Inquiry.
	Title.			
185	Fractures (causes not specified)	1,484	545	36.7
117	Simple peritonitis—nonpuerperal.	1,180	711	60.3
066	Paralysis without specified cause.	3,340	2,090	62.6
061	Simple meningitis.	3,752	2,534	67.5
046	Other tumors (tumors of the female genital organs excepted)	266	196	73.7
062	Locomotor ataxia.	714	558	78.2
186	Other external violence.	1,456	1,158	79.5
067	General paralysis of the insane.	2,042	1,627	79.7
119	Acute nephritis.	4,186	3,375	80.6
020	Purulent infection and septicemia.	820	725	88.4
094	Pulmonary congestion, pulmonary apoplexy.	749	664	88.7
045	Cancer and other malignant tumors of other organs or of organs not specified.	3,650	3,279	89.8
092	Pneumonia (lobar and undefined).	27,740	26,299	94.8
081	Diseases of the arteries, atheroma, aneurysm, etc.	6,390	6,199	97.0
120	Bright's disease.	32,854	32,745	99.7
028	Tuberculosis of the lungs.	60,486	60,613	100.2
009	Diphtheria and croup.	8,850	8,881	100.4
156-163	Other suicides.	2,660	2,674	100.5
029, 032-035	Other forms of tuberculosis.	6,083	6,120	100.6
040	Cancer and other malignant tumors of the stom- ach.	8,804	8,832	101.5
008	Whooping cough.	1,995	2,025	101.5
001	Typhoid fever.	6,343	6,440	101.5
155	Suicide by poison.	1,666	1,696	101.8
006	Measles.	3,137	3,216	102.5
007	Scarlet fever.	3,681	3,778	102.6
039	Cancer and other malignant tumors of the buc- cal cavity.	853	880	103.2
031	Abdominal tuberculosis.	2,067	2,133	103.2
041	Cancer and other malignant tumors of the peri- toneum, intestines, rectum.	2,679	2,769	103.4
042	Cancer and other malignant tumors of the fe- male genital organs.	4,813	5,003	103.9
108	Appendicitis and typhlitis.	3,807	3,959	104.0
043	Cancer and other malignant tumors of the breast.	2,089	2,195	105.1
044	Cancer and other malignant tumors of the skin.	574	604	105.2
064	Cerebral hemorrhage and apoplexy.	21,727	23,029	106.0
182	Homicide by firearms.	1,443	1,532	106.2
091	Bronchopneumonia.	9,133	9,708	106.3
183-184	Homicide by other means.	792	848	107.1
010	Influenza.	3,995	4,370	109.4
A63	Other diseases of the spinal cord.	1,248	1,389	111.3
030	Tuberculous meningitis.	2,656	3,024	113.9
051	Exophthalmic goitre.	368	433	117.7
056	Alcoholism (acute or chronic).	1,353	1,633	120.7
172	Traumatism by fall.	3,575	4,432	124.0
037	Syphilis.	1,322	2,350	177.8
038	Gonococcus infection.	50	115	230.0
A61	Cerebrospinal fever.	138	536	388.4

The indefinite title "fractures (cause not specified)" shows the greatest reduction in the number of assignments. The number of deaths after inquiry is only 36.7 per cent. of the

number originally returned. In view of the fact that the number of persons exposed is constant, the decrease in the number of deaths is accompanied by a corresponding reduction in the death rate. We may, therefore, say that the final death rate for this cause was 63.3 per cent. less than the one which would originally have been quoted. Such general titles as "other external violence" and "cancer of organs not specified" were in like manner greatly reduced through the determination of the nature of the violence, or of the location of the cancer. Considerable reductions were obtained upon inquiry into the character of such returns as "paralysis" and "locomotor ataxia"; for in such cases added information with reference to blood tests, etc., gave sufficient data upon which more definite assignments could be made. On the other hand, a large number of causes, especially those referring to the infectious diseases, show very little change. Tuberculosis of the lungs, for example, shows an increase of but .2 per cent. The infectious diseases of children, such as "measles" and "scarlet fever," give somewhat greater percentages of increase, 2.5 and 2.6 respectively; these increases were made at the expense of terminal conditions, such as "hypostatic pneumonia" and "acute nephritis," which are very often given as the causes of death. Cancers of definitely specified organs were considerably increased in the number of assignments, with a corresponding increase in the rates. Thus "cancer and other malignant tumors of the breast," of which there are many cases, showed an increase of 5.1 per cent. in the death rate. Such socially significant titles as "alcoholism," "syphilis," and "gonococcus infection" gave very marked rates of increase, 20.7, 77.8, and 130.0 per cent., respectively. That we could add two thirds as many deaths as were originally assigned to "syphilis" is in itself sufficient justification for the effort involved by our method. The greatest percentage of increase is shown by the title "cerebrospinal fever," which was increased from 138 to 536 deaths, or nearly fourfold.

The more definite titles to which some of the undesirable titles were changed are shown in the following table:

TABLE II.

ILL-DEFINED CAUSES OF DEATH, AND DEFINITE TITLES TO WHICH RE-ASSIGNED,
BY NUMBER AND PERCENTAGE OF CHANGE IN CLASSIFICATION.

Metropolitan Life Insurance Company, Industrial Department; Mortality Experience, 1911-1914.

Ill-Defined Term as Classified before Inquiry.	Title Assigned after Inquiry.	Number and Per- centage of Changes in Classification.	
		Num- ber.	Percentage of Total Replies.
Purulent infection and septicemia (Total replies, 184.)	Total changes from "Purulent infection and septi- cemia".....	134	72.8
	{ "Other diseases of the uterus".....	6	3.3
	{ Puerperal septicemia.....	54	29.3
	{ Acute abscess.....	8	4.3
	{ Other titles.....	66	35.9
Cancer and other mal- ignant tumors of other organs or of organs not specified (Total replies, 572.)	Total changes from "Cancer . . . not speci- fied".....	423	74.0
	{ Cancer and other malignant tumors of the buccal cavity	25	4.4
	{ Cancer and other malignant tumors of the stomach..	75	13.1
	{ Cancer and other malignant tumors of the peritonum	61	10.7
	{ Cancer and other malignant tumors of the female gen- ital organs.....	148	25.9
	{ Cancer and other malignant tumors of the breast....	83	14.5
	{ Cancer and other malignant tumors of the skin.....	28	4.9
	{ Other titles.....	3	.5
Meningitis (Total replies, 1,653.)	Total changes from "Meningitis".....	1,234	74.7
	{ Tuberculous meningitis.....	294	17.8
	{ Cerebrospinal fever.....	363	22.0
	{ Pneumonia.....	79	4.8
	{ Diarrhea and enteritis—2 years and over.....	62	3.8
Locomotor ataxia (Total replies, 321.)	{ Other titles.....	436	26.4
	Total changes from "Locomotor ataxia".....	163	50.8
	{ Syphilis.....	148	46.1
Paralysis without speci- fied cause (Total replies, 1,449.)	{ Other titles.....	15	4.7
	Total changes from "Paralysis without specified cause".....	1,259	86.9
	{ "Other diseases of the spinal cord".....	175	12.1
	{ Cerebral hemorrhage, apoplexy.....	885	61.1
	{ General paralysis of the insane.....	80	5.5
General paralysis of the insane (Total replies, 956.)	{ Other titles.....	119	8.2
	Total changes from "General paralysis of the in- sane".....	531	55.5
	{ Syphilis.....	491	51.4
Organic diseases of the heart* (Total replies, 714.)	{ Other titles.....	40	4.2
	Total changes from "Organic diseases of the heart"	264	37.0
	{ Cerebral hemorrhage, apoplexy.....	46	6.4
	{ Pneumonia.....	72	10.1
Diseases of the arteries, atheroma, aneurysm, etc. (Total replies, 603.)	{ Other titles.....	146	20.4
	Total changes from "Diseases of arteries, etc." ..	317	52.6
	{ Syphilis.....	65	10.8
	{ Cerebral hemorrhage, apoplexy.....	166	27.5
	{ Other titles.....	86	14.3
Pneumonia† (Total replies, 3,005.)	Total changes from "Pneumonia".....	1,754	58.4
	{ Influenza.....	228	7.6
	{ Bronchopneumonia.....	586	19.5
	{ Lobar pneumonia.....	577	19.2
	{ Other titles.....	363	12.1

* Most of the terms included under the title "organic diseases of the heart" are fairly definite. However, certain expressions like "acute cardiac dilatation" and "cardiac insufficiency" are often reported when they are only terminal symptoms of other diseases. It is these expressions that are covered by our inquiry.

† Assignments to "lobar pneumonia" should be regarded as confirmations of original assignments to "pneumonia," rather than as changes.

TABLE II—*Continued.*

Ill-Defined Term as Classified before Inquiry.	Title Assigned after Inquiry.	Number and Per- centage of Changes in Classification.	
		Num- ber.	Percentage of Total Replies.
Pulmonary congestion, pulmonary apoplexy (Total replies, 155.)	Total changes from "pulmonary apoplexy".....	99	63.9
	Organic diseases of the heart.....	15	9.7
	Chronic bronchitis.....	6	3.9
	Pneumonia.....	8	5.2
	Bright's disease.....	8	5.2
	Other titles.....	62	40.0
Peritonitis—non-puer- peral (Total replies, 575.)	Total changes from "Peritonitis".....	476	82.8
	Abdominal tuberculosis.....	44	7.7
	Diarrhea and enteritis—2 years and over.....	20	3.5
	Appendicitis and typhlitis.....	105	18.3
	Salpingitis and other diseases of the female genital organs.....	45	7.8
	Puerperal septicemia.....	86	15.0
Acute nephritis (Total replies, 1,935.)	Other titles.....	176	30.6
	Total changes from "Acute nephritis".....	839	43.4
	Scarlet fever.....	68	3.5
	Influenza.....	75	3.9
	Alcoholism (acute or chronic).....	213	11.0
	Bright's disease.....	74	3.8
Other diseases of the uterus (Total replies, 173.)	Other titles.....	409	21.1
	Total changes from "Other diseases of the uterus"	119	68.8
	Gonococcus infection.....	15	8.7
	Cancer and other malignant tumors of the female gen- ital organs.....	7	4.0
	Uterine tumor (noncancerous).....	13	7.5
	Cysts and other tumors of the ovary.....	6	3.5
Traumatism by firearms (Total replies, 119.)	Salpingitis and other diseases of the female genital organs.....	21	12.1
	Puerperal septicemia.....	35	20.2
	Other titles.....	22	12.7
	Total changes from traumatism by firearms.....	95	79.8
	Suicide by firearms.....	6	5.0
	Homicide by firearms.....	87	73.1
Fractures (cause not specified) (Total replies, 1,045.)	Other titles.....	2	1.7
	Total changes from "Fractures (cause not speci- fied)".....	949	90.8
	Traumatism by fall.....	646	61.8
	Traumatism by crushing—electric railway.....	33	3.2
	Traumatism by crushing—steam railway.....	25	2.4
	Traumatism by crushing—automobiles.....	27	2.6
Other external violence (Total replies, 504.)	Traumatism by crushing—other vehicles.....	51	4.9
	Traumatism by other means.....	57	5.5
	Other titles.....	110	10.5
	Total changes from "Other external violence".....	400	79.4
	Purulent infection and septicemia.....	15	3.0
	Traumatism by fall.....	161	31.9
Ill-defined diseases (Total replies, 442.)	Traumatism by machines.....	23	4.6
	Traumatism by crushing—electric railway.....	29	5.8
	Traumatism by crushing—automobiles.....	16	3.2
	Traumatism by crushing—other vehicles.....	17	3.4
	Other titles.....	37	7.3
	Other titles.....	102	20.2
Ill-defined diseases (Total replies, 442.)	Total changes from "Ill-defined diseases".....	322	72.9
	Malaria.....	15	3.4
	Tuberculosis of the lungs.....	18	4.1
	Organic diseases of the heart.....	83	18.8
	Bright's disease.....	21	4.8
	Other titles.....	185	41.9

Letters were received from physicians in connection with 1,653 cases originally diagnosed as "meningitis." In 1,234 of these cases, or 74.7 per cent., the classification was changed to other and more definite titles. "Cerebrospinal fever" received 22 per cent. of the original "meningitis" returns; "tuberculous meningitis," 17.8 per cent.; and "pneumonia (lobar and undefined)," 4.8 per cent. The title "paralysis without specified cause" was the subject of 1,449 replies; the classification was changed in 1,259 instances, or 86.9 per cent. The larger proportion (61.1 per cent.) of these "paralysis without specified cause" cases were classified under "cerebral hemorrhage and apoplexy." "Peritonitis" was changed in classification in 476 out of 575 cases, or 82.8 per cent. These changes were credited chiefly to the titles "appendicitis and typhlitis," "puerperal septicemia," "salpingitis," and other diseases of the female genital organs.

Ill-defined returns of "traumatism by firearms" were changed in 79.8 per cent. of the cases queried. The greater part (73.1 per cent.) of these deaths was assigned to the title "homicide by firearms." "Fractures (cause not specified)" were a fruitful source of additions to the class of "traumatism by fall"; 646 ill-defined fractures (61.8 per cent.) were so assigned.

After this examination of the ill-defined terms and the more definite titles to which they were assigned, we may proceed naturally to the other aspect of the change; namely, to determine how the mortality is constituted in those causes which show an increase in the number of deaths. This is indicated by Table III.

TABLE III.

ADDITIONS TO CERTAIN CAUSES OF DEATH FROM INDEFINITE TITLES, NUMBER
AND PERCENTAGE CHANGED FROM EACH INDEFINITE TITLE.

Metropolitan Life Insurance Company, Industrial Department; Mortality Experience, 1911-1914.

Cause of Death Title Receiving Additions.	Title before Inquiry.	Additions.	
		Number.	Per Cent.
Typhoid fever	Total changes to "typhoid fever".....	101	100.0
	Simple meningitis.....	29	28.7
	Organic diseases of the heart.....	3	3.0
	Pneumonia.....	5	5.0
	Other diseases of the intestines.....	6	5.9
	Simple peritonitis.....	16	15.8
	Acute nephritis.....	21	20.8
	Bright's disease.....	3	3.0
	Cause of death not specified or ill-defined.....	3	3.0
	Other titles.....	15	14.9
Measles	Total changes to "measles".....	89	100.0
	Whooping cough.....	3	3.4
	Simple meningitis.....	19	21.3
	Bronchopneumonia.....	9	10.1
	Pneumonia.....	31	34.8
	Acute nephritis.....	13	14.6
Scarlet fever	Other titles.....	14	15.7
	Total changes to "scarlet fever".....	98	100.0
	Simple meningitis.....	7	7.1
	Bronchopneumonia.....	4	4.1
	Pneumonia.....	3	3.1
	Acute nephritis.....	68	69.4
Whooping cough	Bright's disease.....	5	5.1
	Other titles.....	11	11.2
	Total changes to "whooping cough".....	45	100.0
	Simple meningitis.....	12	26.7
	Convulsions of infants.....	2	4.4
	Bronchopneumonia.....	6	13.3
Diphtheria and croup	Pneumonia.....	14	31.1
	Pulmonary congestion, pulmonary apoplexy.....	2	4.4
	Acute nephritis.....	5	11.1
	Other titles.....	4	8.9
	Total changes to "diphtheria and croup".....	35	100.0
	Acute endocarditis.....	2	5.7
Influenza	Organic diseases of the heart.....	2	5.7
	Diseases of the larynx.....	6	17.1
	Acute bronchitis.....	2	5.7
	Bronchopneumonia.....	4	11.4
	Pneumonia.....	3	8.6
	Diseases of the pharynx.....	2	5.7
Tuberculosis of the lungs	Acute nephritis.....	10	28.6
	Other titles.....	4	11.4
	Total changes to "influenza".....	394	100.0
	Simple meningitis.....	40	10.2
	Pneumonia.....	228	57.9
	Acute nephritis.....	75	19.0
Tuberculous meningitis	Other titles.....	51	12.9
	Total changes to "tuberculosis of the lungs".....	168	100.0
	Simple meningitis.....	6	3.6
	Organic diseases of the heart.....	6	3.6
	Chronic bronchitis.....	6	3.6
	Pneumonia.....	70	42.2
Tuberculous meningitis	Cause of death not specified or ill-defined.....	16	9.6
	Other titles.....	62	37.3
	Total changes to "tuberculous meningitis".....	377	100.0
	Meningitis.....	294	78.0
	Other titles.....	83	22.0

TABLE III—Continued.

Cause of Death Title Receiving Additions.	Title before Inquiry.	Additions.	
		Number.	Per Cent.
Syphilis	Total changes to "syphilis".....	1,031	100.0
	Locomotor ataxia.....	148	14.4
	Other diseases of the spinal cord.....	59	5.7
	Cerebral hemorrhage, apoplexy.....	34	3.3
	Paralysis without specified cause.....	34	3.3
	General paralysis of the insane.....	491	47.6
	Diseases of the nervous system other than those speci- fied.....	96	9.3
	Diseases of the arteries, atheroma and aneurysm.....	65	6.3
	Other titles.....	104	10.1
Cancer and other malig- nant tumors of the stomach and liver	Total changes to "cancer and other malignant tumors of the stomach and liver".....	130	100.0
	Cancer and other malignant tumors of other organs or of organs not specified.....	75	57.7
	Other tumors (tumors of the female genital organs excepted).....	7	5.4
	Diseases of the esophagus.....	4	3.1
	Other diseases of the stomach.....	7	5.4
	Other diseases of the liver.....	13	10.0
	Other titles.....	24	18.5
Cancer and other malig- nant tumors of the fe- male genital organs	Total changes to "cancer and other malignant tumors of the female genital organs".....	190	100.0
	Cancer and other malignant tumors of other organs or of organs not specified.....	148	77.9
	Other tumors (tumors of the female genital organs excepted).....	7	3.7
	Uterine tumor (noncancerous).....	7	3.7
	Other diseases of the uterus.....	7	3.7
	Other titles.....	21	11.1
Cancer and other malig- nant tumors of the breast	Total changes to "cancer and other malignant tumors of the breast".....	106	100.0
	Cancer and other malignant tumors of other organs or of organs not specified.....	83	78.3
	Nonpuerperal diseases of the breast (cancer excepted).....	9	8.5
	Other titles.....	14	13.2
	Total changes to "alcoholism".....	289	100.0
Alcoholism	Simple meningitis.....	14	4.8
	Acute nephritis.....	213	73.7
	Cause of death not specified or ill-defined.....	10	3.5
	Other titles.....	52	18.0
Cerebrospinal fever	Total changes to "cerebrospinal fever".....	401	100.0
	Simple meningitis.....	363	90.5
	Other titles.....	38	9.5
Cerebral hemorrhage, apoplexy	Total changes to "cerebral hemorrhage, apoplexy".....	1,408	100.0
	Paralysis without specified cause.....	885	62.9
	Organic diseases of the heart.....	46	3.3
	Diseases of the arteries, atheroma, aneurysm.....	166	11.8
	Bright's disease.....	137	9.7
	Other titles.....	174	12.4
Organic diseases of the heart*	Total changes to "organic diseases of the heart".....	287	100.0
	Cerebral hemorrhage, apoplexy.....	10	3.5
	Paralysis without specified cause.....	13	4.5
	Acute endocarditis.....	10	3.5
	Diseases of the arteries, atheroma, aneurysm.....	14	4.9
	Pneumonia.....	12	4.2
	Pulmonary congestion, pulmonary apoplexy.....	15	5.2
	Acute nephritis.....	25	8.7
	Bright's disease.....	9	3.1
	Senility.....	13	4.5
	Fractures (cause not specified).....	11	3.8
	Ill-defined organic disease.....	39	13.6
	Cause of death not specified or ill-defined.....	43	15.0
	Other titles.....	73	25.4

* See footnote on this title in Table II.

TABLE III—Continued.

Cause of Death Title Receiving Additions.	Title before Inquiry.	Additions.	
		Number.	Per Cent.
Diseases of the arteries, atheroma, aneurysm	Total changes to "diseases of the arteries, atheroma, aneurysm"	126	100.0
	{ Other diseases of the spinal cord	5	4.0
	Softening of the brain	9	7.1
	Paralysis without specified cause	9	7.1
	Organic diseases of the heart	6	4.8
	Pneumonia	5	4.0
	Pulmonary congestion, pulmonary apoplexy	4	3.2
	Acute nephritis	10	7.9
	Gangrene	28	22.2
	Senility	10	7.9
	Cause of death not specified or ill-defined	4	3.2
	Other titles	36	28.6
	Total changes to "bronchopneumonia"	660	100.0
Bronchopneumonia	{ Simple meningitis	32	4.8
	Pneumonia	586	88.8
	Other titles	42	6.4
Pneumonia (lobar and undefined)	Total changes to "pneumonia"	329	100.0
	{ Simple meningitis	79	24.0
	Organic diseases of the heart	72	21.9
	Pleurisy	13	4.0
	Simple peritonitis (nonpuerperal)	10	3.0
	Cerebral hemorrhage, apoplexy	10	3.0
	Bright's disease	44	13.4
	Other titles	101	30.7
Appendicitis and typh- litis	Total changes to "appendicitis and typhlitis"	156	100.0
	{ Intestinal obstruction	6	3.8
	Simple peritonitis (nonpuerperal)	105	67.3
	Other titles	45	28.8
Bright's disease	Total changes to "Bright's disease"	235	100.0
	{ Cerebral hemorrhage, apoplexy	7	3.0
	Organic diseases of the heart	19	8.1
	Diseases of the arteries, atheroma, aneurysm	13	5.5
	Pulmonary congestion, pulmonary apoplexy	8	3.4
	Acute nephritis	74	31.5
	Other diseases of the kidneys and annexa	12	5.1
	Senility	7	3.0
	Fractures (cause not specified)	9	3.8
	Ill-defined organic disease	16	6.8
Puerperal state—total	Other titles	70	29.8
	Total changes to "puerperal state—total"	368	100.0
	{ Purulent infection and septicemia	54	14.7
	Convulsions (nonpuerperal)	32	8.7
	Pneumonia	15	4.1
	Simple peritonitis (nonpuerperal)	87	23.6
	Acute nephritis	58	15.8
	Bright's disease	26	7.1
	Uterine hemorrhage (nonpuerperal)	4	1.1
	Other diseases of the uterus	40	10.9
Puerperal septicemia	Other titles	52	14.1
	Total changes to "puerperal septicemia"	189	100.0
	{ Purulent infection and septicemia	50	26.5
	Simple peritonitis	77	40.7
	Diseases of the uterus	32	16.9
Puerperal albuminuria and convulsions	Other titles	30	15.9
	Total changes to "puerperal albuminuria and convulsions"	125	100.0
	{ Convulsions (nonpuerperal)	32	25.6
	Acute nephritis	54	43.2
	Bright's disease	26	20.8
	Other titles	13	10.4

TABLE III—*Concluded.*

Cause of Death Title Receiving Additions.	Title before Inquiry.	Additions.	
		Number.	Per Cent.
Suicide	Total changes to "suicide".....	46	100.0
	Acute poisonings.....	24	52.2
	Absorption of deleterious gases (conflagration excepted).....	10	21.7
	Traumatism by firearms.....	6	13.0
	Fractures (cause not specified).....	2	4.3
	Other titles.....	4	8.7
Traumatism by falling	Total changes to "traumatism by falling".....	945	100.0
	Simple meningitis.....	43	4.6
	Fractures (cause not specified).....	646	68.4
	Other external violence.....	161	17.0
	Other titles.....	95	10.1
Homicide—total	Total changes to "homicide".....	148	100.0
	Simple peritonitis (nonpuerperal).....	7	4.7
	Traumatism by firearms.....	87	58.8
	Fractures (cause not specified).....	15	10.1
	Other external violence.....	16	10.8
	Other titles.....	23	15.5

Of the 101 cases added to typhoid fever, 28.7 per cent. were originally classified as "simple meningitis," 20.8 per cent. as "acute nephritis," and 15.8 per cent. as "simple peritonitis." There were 89 additions to "measles," 98 to "scarlet fever," 45 to "whooping cough," and 35 to "diphtheria and croup," making an addition of 267 deaths to these four diseases of childhood. "Acute nephritis" played an important part in the original assignment in all of these four diseases, but more especially in "scarlet fever," where 68 deaths, or 69.4 per cent. of the changes, were originally so classified. In like manner, "bronchopneumonia" and "pneumonia" (unspecified), were the original assignments in many of these conditions; this applies particularly to "measles" and "whooping cough." Except for "diphtheria," the indefinite title "simple meningitis" is a convenient cloak for the acute infections of childhood. "Influenza" and "tuberculosis of the lungs" both received significant additions from the title "pneumonia," the former receiving 228 additional deaths and the latter 70. Of the total changes to tuberculous meningitis, 294, or 78.0 per cent., were originally classified as meningitis.

An analysis of the sources of the additions to syphilis is interesting. Of the 1,031 changes to this title, 148 were from locomotor ataxia, 491 from general paralysis of the insane, and 104 from a large number of conditions, connected for the

most part with spinal lesions. Our inquiries with reference to "general paralysis of the insane" have definitely confirmed the virtually unanimous opinion of clinicians that this condition is syphilitic in origin. So uniform is our finding, that we are considering seriously the advisability of discontinuing our inquiries into this condition, and assuming the existence of syphilis in such cases.

As might be expected, the additions to "cancers of specified organs" are at the expense of the residual title, "cancers of organs not specified." The importance of this change is obvious in view of the increasing interest in the location of the malignant growths. The number of deaths from "acute and chronic alcoholism" was increased at the expense of "acute nephritis"; 213 out of 289 deaths, or 73.7 per cent., were so added. It will be unnecessary to go further into this analysis, since the various parts of the table speak for themselves.

The foregoing tables and text are sufficient to indicate the possibilities inherent in the intensive questioning of mortality returns. It does not lie within the power of the statistician to correct errors which depend upon the diagnostic ability of physicians, or upon circumstances which do not permit adequate opportunity for case observation or for accurate clinical or pathological findings. There is, however, a class of errors which he can undoubtedly reduce to a minimum. He can raise the standard of accuracy in mortality statistics by inviting the physician to give information such as he is able and willing to impart. It is reasonable to assume that the physician will, at first, have in mind not so much the statistical use of the information which he possesses as the immediate and uppermost clinical phase of the case. His efforts in the last stage of a losing battle against disease or injury are so often devoted to combating serious complications, that he is more than likely to certify only the immediate and not the primary cause of death. The statistician can tactfully point out to him an error of omission. Experience has demonstrated that, in a large proportion of cases, physicians manifest sufficient interest in the precision of our vital statistics to supply the additional and qualifying statements. As inquiries are made, moreover, physicians become more and more aware of the requirements

of statistical technique in making assignments. An analysis of our returns shows an increasing proportion of satisfactory statements for certain causes of death. A physician to whom an inquiry is once sent will usually not make the same indefinite statement in his subsequent certificates of death.

This means for advancing the accuracy of cause of death statistics is at hand in every registration and compiling office, and it is hoped that it will soon be adopted by vital statisticians generally. The fruitful character of the returns, affecting as they do the basic material of vital statistics, the simplicity of the method, and its low cost both in time and in money, indicate plainly the desirability at the present time of inquiries to physicians as an integral part of the classification of causes of death. Certainly the day has arrived when material cannot be admitted into the realm of good vital statistics unless it has previously been subjected to careful inquiry such as we have outlined above. That is the least which can be expected, in view of the uncertainty of much of the material, due in the first instance to errors of bedside diagnosis uncorrected by autopsy.



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